The Institution of Engineers, Australia; Sydney Division
Engineering Heritage Committee

ORAL HISTORY PROGRAM

INTERVIEWEE: **Barry M. Lee**

INTERVIEWER: **David Butcher**

INTERVIEW DATE: **28 April 1999**

RESTRICTION ON USE: **None**

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IEA SYD : DWB 5, DWB 6, DWB 7, DWB 8.

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INTERVIEW TAPE LOG

This interview took place at Barry M. Lee's home at

16 Payten Street
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on 28 April, 1999.

This interview is part of the Oral History Project of the Engineering Heritage Committee of the Sydney Division of the Institution of Engineers, Australia.

Tape Log

Tape: IEA SYD: DWB 5, Side A		
COUNT	**SUBJECT**	**NAMES & KEYWORDS**
000-004	Tape Identification	
004-016	**Born** Elsternwick (Melbourne) 26.Nov.1933. Father was a compositor in a printing business and subsequently managed a printing business in Latrobe Street, Melbourne, until he retired. Mother was an Army nurse and served through World War II in the Pacific islands and elsewhere. Both parents now deceased.	Elsternwick, Melbourne. Compositor, Printing. Latrobe Street. Army nurse. World War II, Pacific islands.
016-023	**Schooling** - in Melbourne. Almost entirely at Christian Brothers College (CBC), St Kilda. Could not matriculate at CBC, so did last year at St. Kevins (in St. Kilda area). Primary interests science, chemistry, physics, military cadets. Played all sports - not much of a sportsman.	Melbourne. Christian Brothers College (CBC). St. Kilda., St. Kevins. military cadets.
023-038	**Introduction to career in engineering** - probably from interest in science & chemistry. Parents married during Depression and father keen he have secure government job - spent unpleasant 3 months in insurance. But interested in fire side of business and seeing there was scope for more technical approach, enrolled in Engineering. Visited Wormald Brothers in Melbourne when underwriting problem needed technical input - got answers needed and found it absolutely fascinating business.	Engineering Depression Insurance business. Under writing. Wormald Brothers, Melbourne.
038-072	**Qualifications :** Fellowship Diploma Mechanical Engineering from Royal Melbourne Institute of Technology (RMIT). Started when left school, all part time, completed 1956. Delayed by National Service (in 14th National Service Battalion). Graduate (with Distinction) - The Institution of Fire Engineers (UK). Commenced partly by correspondence and partly working with Melbourne Metropolitan Fire Brigade - studied their drills, ladder techniques and equipment, particularly hydraulic operated turntable ladders. Involved in course for 3 years - completed 1958. Required spend some time in UK - Wormald happy as had close links with Mather & Platt in UK. Spent 3 months at Imperial College , London, who ran course and conducted the examinations.	Fellowship Diploma Mechanical Engineering. Royal Melbourne Institute of Technology (RMIT). 14th National Service Battalion. The Instution of Fire Engineers (U.K.). Melbourne Metropolitan Fire Brigade. Turntable ladders. Mather & Platt. Imperial College, London.
072-125	**1951 - joined Wormald Brothers, Melbourne** (few months after starting Engineering course) - early period in Drawing Office (sprinkler system layout), then moved to Special Hazards Department - sophisticated equipment for special applications, eg. carbon dioxide, foam, etc. Most interesting and involved field survey work, stint on drawing board, shop fabrication and commissioning. During this time, Wormald set up shop for manufacture fire extinguishers and started building large vehicles including fire trucks for refineries, airfields, etc on Thornycroft chassis imported from UK. All systems designed and built in Melbourne.	Wormald Brothers Melbourne. Sprinkler system. Special Hazards. Carbon dioxide, foam. Fire extinguisher manufacture. Fire trucks. Thornycroft.

125-164	**Decade 1951 to 1961 - people at Wormald who had notable effect on career :** 1). **Don Dalton** - hydraulics expert who developed special slide rule (in days before computer calculations) & was wizard in practical calculations. 2). **Don Hart** - mechanical engineer influential in large vehicle design. 3). **Keith Charles ("Arch") Winning** - mechanical engineer from University of Queensland - set up machine shop in Melbourne. Was a Wallaby footballer. 4). **Harry Marryatt** - graduate from University of Melbourne. Was top ranking fire protection man in company. Was founder of Fire Protection Association in Australia in 1960. Was sprinkler advocate of note and wrote book which earned him Applied Science degree from Melbourne University - "History of Performance of Automatic Sprinklers in Australia in the century 1896 and on". Barry Lee helped with some illustrations, calculations, proof reading, etc.	Don Dalton, hydraulics. Don Hart, large vehicles. K.C. ("Arch") Winning. Wallaby footballer. Harry Marryatt. Fire Protection Association in Australia. "History of Performance of Automatic Sprinklers in Australia in the century 1896 and on".
164-243	**1961- transfer to Wormald Headquarters, Sydney.** Reason - career prospects better. **1). Special Hazards** - eg. gas liquefaction, refineries, etc. which have to be handled by methods other than automatic sprinklers and fire alarms. Wormald had set up major facility centred in Sydney to cover all of Australia and New Zealand - went as Assistant Manager of that group - later Manager. **2). Product Development** - because had product development skills, was transferred out of Special Hazards group to look after general product development as a corporate function in Sydney to about 1964. Talked about various product developments : • Solid state fire detectors (to respond to rate of temperature rise as well as fixed temperature). • Portable fire extinguishers. • Vehicle development (including time in Germany). • Hydraulic platforms. • Carbon Dioxide (CO_2) systems and the understanding of two phase flow.	Wormald, Sydney. Special Hazards. Gas liquefaction, Refineries. New Zealand. Product development. Solid State Detectors. Temperature rise. Portable Fire Extinguishers. Hydraulic platforms. Carbon Dioxide (CO_2). Two phase flow.
243-270	**Special Hazards** - generally discussed meaning of these, for example, a). Water Spray and the creating of temporary emulsions for transformer oil fires & turbine oil systems. b). Foam systems. c). Dip Tanks and Heat Treatment processes.	Water spray. Emulsion. Foam Tanks. Dip Tanks & Heat Treatment.
270-289	**1964 - appointed Associate Director** - based Sydney at Waterloo, where Wormald's entire facilities , called Park Works, were located in Young Street, Waterloo. Works were named after big plant in Manchester - an affiliate of Wormald. Waterloo facilities subsequently all dispersed and buildings demolished - only thing left is sprinkler tank as part of overhead tank as part of a set of offices.	Associate Director. Waterloo. Park Works. Young Street, Waterloo.
289-333	**1970 - Appointed Technical Director** - based Sydney. By this time Waterloo Works shut down & relocated to western suburbs. The Chairman had said - "we should not be fabricating pipe on this valuable real estate, we should be making watches or something like that".	Technical Director Waterloo Works. Western Suburbs.

	Main office transferred to Crows Nest (corner Alexander & Ernest Streets) to a building occupied for some years. Now directing all of company's technical operations - i.e. engineering standards, design standards & manuals which were issued to drawing offices throughout Australia & New Zealand. Company maintained a fire protection drawing office in every state - they responsible for generating working drawings to company standards. Responsibilities also included maintaining fire records which Harry Marryatt had initiated. During 1970's - vacated Crows Nest building & moved to a location in North Ryde. At that time (in 1970's), Wormald realised could not expand unless it had greater territory and decided appropriate to expand & operate elsewhere - ***continued at end last few minutes of this tape side...***	Crows Nest. (corner Alexander & Ernest Streets). Engineering standards, design standards, manuals. New Zealand. Fire records. Harry Marryatt North Ryde. Wormald - expand / operate elsewhere.
333-394	**<u>Development of Sprinklers</u>** - ***backtracking to founding & early history of Wormald :*** Company in Manchester, UK, called Mather & Platt dating back to 1804 -had origins in production of textile machinery & was pioneer of automatic sprinklers in Britain mostly to service cotton mills which were terrible fire hazards. In 1883, it's chairman (Sir William Mather) visited United States as part of a Royal Commission on higher technical education. In process of visit, he met with Frederick Grinnell at Providence, Rhode Island. Grinnell had developed at that time the first really successful commercial sprinkler - Grinnell patented the sprinkler in 1882. For a sprinkler to respond accurately and not leak was no small feat. Sir William Mather expressed real interest - also Grinnell serviced the textile industry which was centred in Rhode Island. So Mather secured rights (licence awarded in 1889) for this sprinkler in rest of world outside United States. Was marvellous coup at the time & brought it back to Manchester. So Mather & Platt pioneered Grinnell sprinklers in rest of world. One of Mather & Platt board members was John Wormald (later Sir John) - insurance man who wrote first set of sprinkler rules for use in UK - before any rules were formalised in United States. He sent brother of his to Australia plus another brother to see what could be done out here - hence the company was called Wormald Brothers & was founded in Sydney in 1889. So, Grinnell sprinklers were in use in UK & rest of world through Mather & Platt, in United States through Grinnell and in Australia & New Zealand through Wormald Brothers - ultimately a separate company.	Sprinklers Mather & Platt, Manchester, UK. Automatic sprinklers. Cotton mills. Sir William Mather United States. Frederick Grinnell. Providence, Rhode Island. Textile industry. John Wormald (later Sir John). UK United States. Wormald Brothers.
	<u>Returning to Wormald wanting to expand & operate elsewhere</u> - Contin. from Counter 333 this Tape side: Wormald had out grown it's territory and asked Mather & Platt if it could have some more territory in South East Asia - answer was resounding NO. So Wormald decided to go on it's own - it ultimately acquired some stock in Mather & Platt and in due course (in 1976) purchased Mather & Platt. ***.....continued on Tape DWB 5 , Side B ,***	Wormald - expand / operate elsewhere. Mather & Platt. South East Asia. Mather & Platt
394	**End of Tape IEA SYD : DWB 5, Side A**	

Tape Log

Tape: IEA SYD: DWB 5, Side B		
COUNT	**SUBJECT**	**NAMES & KEYWORDS**
000-003	Tape Identification.	
003-065	***Wormald purchase of Mather & Platt - continued from Tape IEA SYD : DWB 5 , Side A:*** Having acquired Mather & Platt, Wormald had international coverage plus increased product range. Mather & Platt operated significant foundries, were active in food machinery, textile machinery, pumping equipment and had a fire engineering division. **1974 - appointed Technical Director - Fire Engineering - Wormald International** Did all reporting on research and development on fire protection worldwide. Wormald purchased in 1978 a company in United States - Ansul - based in Wisconsin - originally a chemical company. Ansul name derived from anhydrous sulphur dioxide which was used as a refrigerant at the time. Ansul was a pioneer in use of Dry Chemicals for fire protection - which was an European development - brought to United States & were very successful with it. Ansul located in remote area - but where refrigerants & fertilisers of great importance as Wisconsin is dairy country. Another great feature (still applies) - remote & in wooded area - could have big test fires and not worry about environmental / pollution problems. Developed a fire school for people who were going to use the apparatus. Is a significant research & development group. Mather & Platt had 3 research elements : 1. pump business. 2. food machinery. 3. fire engineering - about 50 strong - mechanical & electrical engineering people and chemists. In Australia, fire research group was about 30 strong & principally concerned with hydraulics & computerised techniques development for hydraulic calculation & portables business. Also, by virtue of acquisition of Mather & Platt, controlled also groups • M.B.John Valves at Ballarat - with large foundry. • Kelly & Lewis pumps - interesting as Barry Lee's father did all catalogue printing for Kelly & Lewis in days before Wormald owned them. As **Technical Director, Fire Engineering,** responsibility was to draw all research together in terms of reporting to the Board - status each project, milestones, targets, progress, where intended to head, etc.... Still based in Sydney but travelled extensively.	Mather & Platt. foundry, food machinery, textile machinery, pumping, fire engineering. Technical Director, Fire Engineering.- Wormald International. Wormald. Ansul, Wisconsin, United States. Anhydrous sulphur dioxide. refrirrigerant. dry chemicals. refrigerants fertilisers dairy country. Fire school. Mather & Platt, research. Pump business. Food machinery. Fire engineering. M.B.John Valves., Ballarat. Foundry. Kelly & Lewis Pumps.
065-092	**1990 - appointed Technical Director Tyco International Pty. Limited** ***Tyco purchased Wormald in 1990 - talked about the events which led to Tyco acquiring Wormald :*** Wormald was a public company & during frenzied takeover activities in late 1980's in Australia - was bid for a couple of times by prominent people - managed to	Tyco International Pty. Ltd. Wormald.

	stave them off. Board ultimately sought a 'white knight' - did this with a prominent Chinese entrepreneur but fell foul of Stock Exchange when trading stocks. Whilst in difficult situation, the third member of loosely associated group (comprised Wormald Australia / Mather & Platt (UK) / Grinnell, Providence, RI) - i.e. Grinnell was acquired by Tyco in the USA. Tyco had been founded 1962 as a materials testing laboratory - derives name from son of founder Tyler Rosenberg . Principal jewel in Tyco's crown was the Grinnell company in Rhode Island. Tyco in 1990 bid for & secured the Wormald operation.	Chinese. Stock Exchange. Mather & Platt. Grinnell, Providence, RI. (RI = Rhode Island, USA.) Tyler Rosenberg. Rhode Island.
092-149	**Effect on Wormald Australia operations from takeover by Tyco International Pty Ltd :** 1. **Positive** - owner in same line of business - technically good. Considerably enhanced financial strength. Become world's largest fire protection organisation. 2. **Down side** - was some expropriation of research & development (R & D) facility in Australia. Wormald Australia had been basically self sufficient with products manufactured in Australia - all of this taken back to United States & merged with their manufacture. R & D now headquarted in Providence. Virtually all Tyco research now done in USA - not done internationally. Still small R & D pocket in Germany because Germans have special constraints and rules which require them to develop special variations on equipment - so they been able to maintain what they did. There is a small research element in UK to support Common Market operations. Research in Australia very reduced in scope - includes detectors (reliable high speed) using residual skills from Wormald which is continuing to be maintained. Also Australia still does work associated with sophisticated hydraulic calculations - not just water based systems - but other fluids eg. carbon dioxide and multi phase flows. Australian still does research on detection equipment - done at Dee Why West (Sydney) where electronic equipment is headquartered. Mathematical exercises are done in South Australia.	Tyco International Pty. Ltd. Fire protection. Research & development, R & D. Wormald United States. Providence. Germany. UK Common Market hydraulic calculations carbon dioxide, multi phase flows. Detection equipment. Dee Why West, Sydney. South Australia Mathematical exercises.
149-168	**Current position & plans:** A consultant to Wormald - possibly to end this year. Finished up as full time employee about 18 months ago. Talked about plans, eg. writing, technical notes, etc.	consultant
168-230	**Experience - 45 years in fire protection engineering -** • Made regular study visits to major fire protection research organisations outside Australia - in UK, Europe, USA, Canada, Middle & Far East. • Speaker at conferences in Australia, New Zealand, Europe, USA, China & South East Asia. ***First class fire research facility at Hertfordshire in UK*** - formerly run by Dept. of Scientific & Industrial Research and today by Ministry of the Environment. Excel in general fire research, problems with large shopping malls, tall buildings - considerable interest in smoke control, smoke movement under fire conditions & generation of toxic gases. Instrumental in developing laser fire detectors, special foam pumping equipment & variations on extinguishing themes & made notable toxicity studies with some of these extinguishants.	Fire protection research organisations. Hertfordshire, UK, research facility. Dept. of Scientific & Industrial Research (UK). Shopping malls. Tall buildings. Toxic gases. Laser fire detectors. Foam pumping equipment.

	Factory Mutual Laboratory & Underwriters Laboratory in USA- also talked about these - similarly very open in discussing things they have developed. ***Member of Australian Trade Mission to China just after Cultural Revolution - about 1967 - most exciting.*** Invited back in 1968 to run week long seminar at University in Beijing in various facets of fire engineering practice from principles & techniques to compartmentisation principles & to elaboration of the state of the art around the world as 'we' see it.	Factory Mutual Laboratories & Underwriters (USA). Australian Trade Mission to China (1967). University in Beijing.
230-256	**<u>Wormald - company & attitudes:</u>** Talked about Wormald's attitude of sending it's people around world to ensure kept abreast of developments & technology and importance of a fire protection company like Wormald during World War II in the defence effort. Yet when time came for company to be acquired, only interest really was in financial matters - not intrinsic value to Australia of an engineering element of some importance that not only underpins our defence effort, but our power station practice, building technology, etc... All was done without that much thought as to intrinsic value of the company to Australia.	Wormald World War II. Australia - engineering element.
256-341	**<u>Involvement in number of firsts in the Australian fire protection scene:</u>** **<u>1). Wide bodied aircraft hangar installations :</u>** Specific challenges due sheer size, huge aircraft footprint and their capital cost. Very complex systems. Fire protection system could be 10% of building structure - markedly higher than for tall city building where fire protection system could be 2½% of total cost of structure. When aircraft in hangar, fire protection system is fraction of a percent of total cost of the risk. In a fire, 2½minutes before aircraft skin penetration - could be total loss or hangar failure which would impact on aircraft. Challenges bound up with huge footprint of aeroplane on floor - if fuel spill on floor, conventional fire protection technology (ie. overhead sprays & deluge systems) simply cannot handle as they cannot go to seat of the fire. Need systems which very fast to detect possibility of fuel (or other hydraulic fluid) spill - eg. radiation sensors (infra red, ultra violet types & combinations). Sensitivity poses problems as can be triggered by welding or lightning strikes. To get immunity from false alarms has involved development of dual spectrum technology, so both passive & near infra red have to be seen or passive plus infra red plus UV all have to be seen before system will trigger - but starts in milliseconds. Must have top side application of foam plus low level to get under vast shadow of the aeroplane. Systems in Australia - tendency has been to use water deluge from roof & foam beneath aeroplane - oscillating monitor system around periphery of hangar but with long range to get through forest of equipment around aeroplane when it is being maintained. For military aircraft, huge dependence on avionics - often will not have anything overhead - do not like oscillating	Wide bodied aircraft hangars. aircraft footprint. Fire protection costs. Aircraft skin. Overhead sprays & deluge systems. Radiation sensors. Infra Red, Ultra Violet. Dual spectrum technology. Water deluge systems. Oscillating monitor system. Military aircraft. Avionics.

	monitors - developed telescoping pop up foam nozzles all built in below floor - done at Filton Works for Concorde. There are variations on the theme - but typically combination of water & foam - called "aqueous film forming foam" which forms an interference film across surface of the flammable fluid.	Telescoping pop up foam nozzles. Filton Works, Concorde. Aqueous film forming foam.
341-369	**Comparison between aircraft hangars and large warehouses or bulk stores -** handle in much same way : • Assess the fuel load density. • Configuration & geometry of the fuel and how that might alter characteristics of fire should it develop. **Warehouse practice** - has gone higher & higher - tall stacking presents huge problems because flue spaces between stacks of stored commodity are great fire generators. Fire races up those vertical canyons in few minutes and severely overtaxes orthodox sprinkler protection installed at roof of high bay warehouse. Has involved huge changes in years of his involvement. Used to use intermediate level sprinklers dispersed at various levels, or tiers, in the racking - very difficult to accomplish because easily damaged by forks on trucks or handling picker equipment. Latterly have developed - Fast Response Time Sprinklers.	Large warehouses or bulk stores. Fuel load density. Stacking, flue spaces. High bay warehouse. Intermediate level sprinklers. Fast Response Time Sprinklers.
369-423	**Fast Response Time Sprinklers** - ***one area of great interest during tenure in Research & Development (R & D) was to find a more sensitive sprinkler.*** Wanted faster operation (although orthodox sprinkler track record been excellent) - now building regulations emphasis on life safety as opposed to property protection. Have been very few fatalities in sprinkler protected buildings. Where it has happened, was usually from contact burns - eg. someone smoking in bed & already badly burned before the sprinklers had operated. Another case was at a match factory near Richmond - person pushing trolley of packets of matches - they ignited & person was severely burned before sprinklers came on - although they saved all other operators on the floor. Sprinklers needed to be faster operating if their role is in life saving rather than structure / building protection. In last decade, considerable progress has been made in sprinkler technology - smaller & more slender but stronger fusible elements which can respond 4 to 5 times faster than orthodox sprinklers Method of assessing this is in wind tunnel - comparator used between sprinklers is "Response Time Index" - RTI - which is a measure of their Time Constant - i.e. their ability to respond when a preset temperature is reached. Using RTI has demonstrated can use sprinklers in hospitals, old folks' homes, even private residences and give fairly sound assurance of being able to save lives. ***Continued on Tape IEA SYD ; DWB 6, Side A.....***	Fast Response Time Sprinklers. Research & Development, R & D. Building regulations. Sprinkler protected buildings. Match factory, near Richmond.. Wind tunnel. Response Time Index - RTI. Time Constant.
423	**End of Tape IEA SYD : DWB 5, Side B**	

Tape Log

Tape: IEA SYD: DWB 6, Side A		
COUNT	**SUBJECT**	**NAMES & KEYWORDS**
000-005	Tape Identification.	
005-022	**Faster Response Time Sprinklers**.....*continued from Tape IEA SYD ; DWB 5, Side B:* Faster response sprinkler bulbs, ie. fusible elements, were developed in effort to ensure tenable conditions maintained long enough to cover evacuation period - absolute of minimum 10 minutes. Have been able to accomplish tenable conditions, which mean : • Temperatures kept at acceptable levels. • Carbon monoxide at acceptable level. • Oxygen depletion at acceptable level,.... & so on..... **Faster response sprinklers had immediate applicability to high rise storage facilities**. Rather than use sprinklers at intermediate levels, were able to use fast response sprinklers at overhead only & larger drops in those sprinklers (ie. larger bores) - somewhat bigger piping capacity but because of fast response & direct application, opened fewer sprinklers and accomplished more than what could be done with orthodox sprinklers.	Fast Response Time Sprinklers Tenable conditions. Temperature Carbon Monoxide Oxygen depletion High rise storage facilities.
022-112	**2). High Expansion Foam installations :** Foam is simply air filled bubbles - 3 components : • water • foaming concentrate (similar household detergent - but with special characteristics to resist high heat) • means of agitation to generate a foam Conventional foam turret on a fire truck or nozzle in an aircraft hangar takes combination of water plus foaming concentrate - when arrives at nozzle is agitated mechanically or through venturi type apparatus - aspirates air & develops a bubble. Expansion of liquid volume of order 7 to 1 (upper limit 30 to 1) - this called **low expansion foam**. Research in UK by Mines people at Buxton Research establishment discovered if make a much lighter bubble, ie. much more highly expanded foam, could fill mine galleries with inert atmosphere in which people could survive as bubbles contained air. Soon obvious to industry that **high expansion foam** (expansion up to 1,000 to 1) with much lighter cellular structure bubbles & enormous quantities of foam could be used elsewhere. Have used **high expansion foam in several cases in Australia** - eg. storage of rolls of paper on end for newsprint - poses huge problems as rolls are moveable - commented one must see the burning characteristics to believe it. If can build up foam very quickly from floor - gradually submerging the paper - in effect reduces the height against which the overhead sprinklers must operate. eg. if paper rolls 20metres tall & can quickly fill to 10metres depth in couple of minutes with highly expanded foam, then overhead conventional sprinklers only have to cover 10metres of exposed product. These two systems working together provide excellent fire protection. Also, because water has expanded 1,000 times, quantity water applied is minimal & therefore little damage to the paper.	High Expansion Foam. Foaming concentrate Low expansion Foam. Buxton (UK) Mines Research establishment. Mine galleries. Air bubbles. High Expansion Foam. Rolls of paper, newsprint. Overhead sprinklers

	Commissioning of high expansion foam systems in practice - Underwriters wanted full scale tests. Have done 3 or 4 dozen in Australia & filled major warehouses - eg. Newcastle Advertiser and Fairfax in Sydney. In all cases, fully functionally tested with virtually no residual damage & no write off of product. ***High expansion foam has been used in small commercial aeroplane hangars*** where water supplies not readily available - because 3 dimensional - looks after spillages plus upper reaches of lighter aircraft. **Advantage of high expansion foam** - uses least amount of water for a given application and least damage to product as a result.	Commissioning - high expansion foam. Newcastle Advertiser. Fairfax in Sydney. small commercial aeroplane hangars.
112-206	**3). Introduction of various systems :** **3.1). Large scale Dry Chemical.** Originally developed in Europe - then imported to USA & rest of world. Dry chemical, as originally formulated, is sodium bicarbonate (baking soda) with additives to confer • water repellency • flowability • non compacting characteristics Is still a matter of debate why sodium bicarbonate is an extremely effective fire extinguishant. Originally thought released carbon dioxide and water vapour - but it does not. Current popular view - to do with free radical theory that can interfere with chain reaction that is part of fire process by locking on to otherwise free chain branching radicals that characterise combustion. Verified somewhat by fact that potassium bicarbonate found to be twice as effective on weight for weight basis. Other quite toxic chemicals were even 4 or 5 times more effective. The more finely divided the dry chemical, the more effective the extinguishant - so is clearly associated with surface available to stop or inhibit a reaction. Practical problem - the more finely divided the chemical - less momentum - cannot project it as far. Dry chemical originally developed for use on flammable liquids. Large scale dry chemical - particularly aircraft crash rescue - where can be huge spillages & instantaneous ignitions & need very rapid knockdown of fire to have any chance of saving people's lives. So quick response vehicles been developed - best ones have combination of dry chemical and foam - dry chemical to secure immediate knockdown & foam to secure the entire thing against re-flash & re-ignition. Initial knockdown very important - need huge quantities of dry chemical - eg. the large chassis from Germany which carry 60 tonnes of dry chemical & huge plumbing system & nozzles. In Australia, number of situations where large scale dry chemical required - either as static or as truck mounted. In 1964 - visited speciality company in Texas (USA) & secured licence rights to build apparatus in Australia. Wormald built number of these - spherical containers which rotated at time of operation - in effect shook containers & created fluid bed at same time with internal pressure system. First applied for Mobil (at Pulpit Rock - thinks now gone) which was huge hazard problem at big	Large scale Dry Chemical. Europe, USA. Sodium bicarbonate (baking soda). Potassium bicarbonate. Flammable liquids. Dry chemical Aircraft crash rescue. Germany. Texas (USA). Wormald Mobil (Pulpit Rock).

	drum filling rack in middle of an urban area. They needed something that was fast acting - so developed a fixed dry chemical system, based on these big spherical containers, that projected dry chemical over entire container filling location. Fully function tested - caused great powder cloud for a time - obviously a clean up problem with dry chemical - but efficiency unquestioned. Other applications include	Drum filling.
	• For exotics used in petroleum refinery process - eg. aluminium alkyls which ignite immediately on exposure to air - have to be kept in sealed containers - important catalysts. Not produced in Australia - but brought here in ships. Wormald developed fire trucks which go to docks, accompany shipment to refinery & standby for entire time they used - as an emergency.	Aluminium alkyls. Petroleum refinery process. Fire trucks
	• LNG (Liquefied Natural Gas) - very important in Western Australia - large scale dry chemical used extensively.	LNG (Liquefied Natural Gas). Western Australia
206-268	**3.2). Aqueous Film forming Foam -** as distinct from high expansion foam or mechanical foam. Initially foams produced by chemical reactions as a precipitate - with acid & alkali solutions - old foam extinguishers worked in this way. Called ***chemical foam*** & were carbon dioxide filled bubbles. System was extended to shipboard for bilge space protection - there were a number of ships on Australian coast in late 1950's with such chemical foam systems. In late 1930's ***mechanical foam*** developed - so called because some agitation required to produce foam - done with either rotary vane pumps or by venturi. Mechanical foams generally based on protein rich materials - eg. feathers, bones, etc - foul smelling, but produced a very stable foam. Late 1960's, was huge fire on aircraft carrier USS Forrestal - destroyed much of shipboard equipment & aircraft & loss of life. Decided more efficient foam needed - made use of fluorine chemistry using fluoro carbon based concentrate - using same principles as before - low expansion foam from 7 to 1 up to 30 to 1. Conferred huge stability on foam & much greater heat resistance in bubble wall so greater endurance at attempts to burn the foam back. Greatest feature was extremely rapid fire extinguisher. So effective - even today some trucks use this **"aqueous film forming foam"** - i.e. **"AFFF".** Not only is bubble stable, but what drains from the bubble is in effect a membrane - a light surface skin which floats on water & seals so prevents flashback. Original trade name was "Light Water " because it floated on water. Has had tremendous impact - used by many refineries & our defence forces today use very little protein foam & concentrate on this 'film forming foam' - which has another feature. Is said to be oleophobic or hydrogen shedding - resistant to destruction by hydrocarbons & therefore can be applied sub surface to major tanks instead of applying it from top side where it can easily be deranged by lightning strike or explosion on the tank. It can be injected into base of tank & float through the tank without being destroyed & form a film on the top.	Aqueous Film Forming foam. Chemical reactions. Foam extinguishers. Carbon dioxide. Shipboard protection. Bilge space protection. Australian coast. Mechanical Foam. Protein rich materials. Aircraft carrier USS Forrestal Fluoro carbon. Aqueous film forming foam AFFF Light water. Refineries, Defence forces. oleophobic, hydrogen shedding. Sub surface to tanks.

268-287	Describes the ***original system in the aircraft carrier USS Forrestal & what ships (particularly combat ones)*** use nowadays - i.e. aqueous film forming foams.	Aircraft carrier USS Forrestal Combat ships.
287-357	**3.3). Halon 1301 Systems.** Halon 1301 - called bromo trifluro methane (CF_3Br), belongs to a whole family of halogenated hydrocarbons. 'Halon Nomenclature system' devised to avoid use of long & unmanageable chemical names : 1st digit - eg. 1....no. of carbon atoms. 2nd digit - eg. 3....no. of fluorine atoms. 3rd digit - eg. 0....no. of chlorine atoms. 4th digit - eg. 1....no. of bromine atoms. Halon 1301 was original, most efficient & widely used halon - is a compressed liquefiable gas so can be stored in cylinders at modest pressure. Halon 1301 is extremely efficient extinguishant - eg. some 3% by volume in an enclosed space would achieve extinguishment. Was widely used all over world. Came into vogue at time of increasing use by all sorts of industries for EDP (Electronic Data Processing) facilities - high value electronic installations. Suddenly - found to be an ozone depleter along with CFC's & an alternative had to be found - has proved to be a huge problem - even today, have not found a perfect replacement for Halon 1301. Halon 1301 had minimal decomposition products that were toxic, had high efficiency & used small quantities. Today used in most aircraft power plants as fixed system. ***Search for alternatives to Halon 1301*** - research involved far exceeded capabilities of fire protection engineering companies - involved sophisticated chemical studies - by for example Dupont, ICI, Eugene Kuhlmann - all round world working to find a solution. Many candidates found - on one score or another - they fall short - eg. toxicity implications not acceptable or too much agent to do the job & so on.	Halon 1301 Bromo trifluro methane CF3Br Halon Nomenclature system Enclosed spaces. Liquefiable gas. EDP (Electronic Data Processing) facilities. Ozone depleter. CFC Alternatives to Halon 1301. Toxicity Dupont, ICI, Eugene Kuhlmann
357-396	**3.4). INERGEN - new breathable inert gas** ***- possible replacement for Halon 1301.*** Has grown from research in two areas : • Submarine atmospheres & caisson work - where has been concern of oxygen deficient atmospheres. • Space program - concern re controlled atmospheres in space craft. Talked about how work on breathable atmospheres, but with reduced oxygen content, became of interest to fire protection business. INERGEN derives name from fact it is inert & is based primarily on nitrogen. Intention is to reduce normal oxygen content from 21 - 20.8% to something less than 15%. At something less than 15% volume concentration, most fires are extinguished. ***Continued Tape IEA SYD : DWB 6, Side B.....***	INERGEN Breathable inert gas. Submarine atmospheres. Caisson. Space program. Controlled atmospheres. Inert, nitrogen. Oxygen content.
396	**End of Tape IEA SYD : DWB 6, Side A**	

Tape Log

Tape: IEA SYD: DWB 6, Side B		
COUNT	**SUBJECT**	**NAMES & KEYWORDS**
000-003	Tape Identification.	
003-082	***Continued from Tape IEA SYD : DWB 6, Side A.*** ***<u>INERGEN - possible Halon replacement</u> - continued...:*** If get oxygen content down to 12% volume concentration - almost guarantee to extinguish all fires - problem these atmospheres not breathable or very difficult to breath. INERGEN is novel - made up of mixture of gases • Nitrogen.....52% • Argon.....40% • Carbon Dioxide...8% Carbon Dioxide is a respiration trigger - we rely on carbon dioxide we produce to trigger our breathing - without small quantity of carbon dioxide in the air , we could not breath at all. Stored compressed at pressure upwards of 200bar in steel cylinders in accurately controlled mixture - when discharged in a compartment, some gas lost through openings, etc. - putting in inert gas & displacing some air & gradual pre mixing - ultimately oxygen below 15% & carbon dioxide up to 4% (no more) - controlled as direct function of what was stored in cylinder. The carbon dioxide promotes deeper & more rapid breathing - even in unconscious subject. If get explosion preceding fire - if compartment filled with INERGEN - people can breath & be rescued. When technology introduced into Australia - recognised Wormald engineering people - needed medical people to be sure OK. INERGEN is result of work in University of Pennsylvania Medical School - went there & talked to professor in question (had been decorated by NASA for his work). Also got corroborating opinions from Prince of Wales Medical School. Wormald had technology endorsed by a number of medical people. Have widely applied technology in Australia - had one or two cases of system operating and all was well. Because INERGEN is compressed gas as opposed to compressed liquefied gas & because is an inerting agent as opposed to a very efficient chemical extinguisher, it cannot compare with Halon 1301 in terms of quantity required. Whilst satisfactory for EDP facilities, INERGEN cannot be used for aircraft power plant or shipboard machinery spaces. Whilst has solved a lot of problems - is not the perfect solution - generation of toxic decomposition products in a fire, eg. hydrogen chloride, hydrogen fluoride, etc., & the importance of evacuating people quickly.	INERGEN Halon Nitrogen Argon Carbon Dioxide Respiration trigger. Inert gas Explosion Wormald Medical people University of Pennsylvania Medical School. NASA. Prince of Wales Medical School. Halon 1301 EDP facilities Aircraft power plant. Shipboard machinery spaces. Toxic decomposition products.
081-163	**<u>4). Design & production of portable extinguishers</u>** • **<u>Stored pressure water</u>** • **<u>Foam</u>** • **<u>Dry Chemical</u>** **<u>and relative merits & applications of these different types of fire extinguishers</u>**. Emphasised - there is no one fire extinguisher which handles all classes of fire.	Portable extinguishers Stored Pressure Water. Foam. Dry Chemical.

	Described international classification system for fires, eg. Cellulosic material - Class A, Flammable Gas - Class B, Flammable Liquid - Class C, Energised Electrical Equipment - Class E, & so on. Described development of various types and suitability since originally developed water based extinguishers. German produced multi purpose dry chemical based on monammonium phosphate or more specifically monammonium dihydrogen orthophosphate ($NHPO_4$) - same, if not better, Class C extinguishing capability as sodium bicarbonate. If impacts on a hot surface, immediately forms oxygen excluding crust - could be simultaneously used for Class A & Class C. This about as close as would get to multi purpose extinguisher, with possible exception of finely divided water or mist or fog - which is currently being experimented with extensively - Tyco looking at for major tunnels. Development of stored pressure cylinders for fire extinguishers - talked about developments today.	International classification system for fires. Cellulosic material. Flammable gas. Flammable liquid. Energised Electrical equient. German multi purpose dry chemical. Monammonium phosphate. Monammonium dihydrogen orthophosphate ($NHPO_4$). Multi purpose extinguisher. Finely divided water, mist, fog. Stored pressure cylinders.
163-202	**Developments / Projects felt to have been of particular interest or significance** : **a). Response Time Index (RTI) :** In connection with improved sprinkler sensitivity - refer earlier Tape IEA SYD ; DWB 5, Side B (369 - 423) & Tape DWB 6, Side A (005 - 022) - considers this the most significant development in sprinkler technology. Had major impact on way systems designed & installed. Design based on conventional sprinklers with heat release calculations, etc. to determine how many sprinklers will open - based on 100 years of experience. But not yet fully known with the new fast response sprinklers - much more research & work needs to be done.	Response Time Index (RTI) Sprinkler sensitivity. Heat release.
202-276	**b). Most satisfying project worked on - Halon 1301 systems in USA guided missile frigates :** In days of Halon1301 & when Wormald was independent Australian owned company - developed own hardware devices & systems technology for use with Halon 1301. Applied all over Australia for commercial applications. Heard about heavy defence offset program between US & Australia - meaning US owed Australia some return work for equipment which Australia had purchased in US. US about to start building program for 70 guided missile FFG-7 frigates - of which Australia purchased about six. Described how Wormald secured design & work & provided all fire protection systems to all of the 70 US built frigates. Halon 1301 was agent of choice - there were to be some 11 sub systems on each ship - protecting auxiliary machinery components, main machinery & so on - but had no idea how to get share of the work. With contacts from Dept. of Defence, travelled to shipyards in Maine (USA) - talks if possible use Australian systems. Totally unprepared use something from "antipodes" on US military vessels - were established people who had equipment approved to US defence standards - talked & talked & they knew they had some obligation - reasoned could get better deal here & keep traditional suppliers honest.	Halon 1301. USA guided missile frigates. Defence offset program between US & Australia. Guiided missile FFG-7 frigates. Wormald Dept. of Defence Maine (USA), shipyards. US military vessels.

	Similar lukewarm response from Todd shipyard. At time, Wormald had no equipment designed anything like military standard - US said have 1 month before bids close & would be prepared to entertain a bid. Wormald principals said if convinced can have all facilities here. Put all hands on - worked around clock - developed & tested hardware from ground floor up. Valving - chose aluminium bronze as in aggressive environment - never been cast in this country at time - M.B.John (Ballarat) had facilities & ultimately cast these valves. Every pour had to have coupons, be tested, etc - valves designed here & shock tested in Adelaide (which had apparatus). Ultimately whole thing designed - bid put & secured. Felt this huge coup - big team of engineers, etc. - feel was one of most successful jobs ever did.	Todd shipyard - west coast - Long Beach, USA. Aluminium bronze. M.B.John (Ballarat).
276-352	**<u>Challenges /problems / "disasters" - often more enlightening than smooth flowing no hitch jobs.</u>** **<u>1). CSR Pyrmont - Rum Storage / Distillery.</u>** Was old works in urban environment - pressures to make sure had adequate fire protection. Decided high expansion foam as best option - but due highly flammable situation with explosive atmospheres in various parts, orthodox method of providing electric motor driven fan and generator modules at various locations in upper roof structure not appropriate. as always risk of spark. Idea conceived locate diesel driven fan in safe place exterior to buildings and duct over top warehouse to various points and make foam there (no moving parts) & use pneumatic shuttters. In commissioning, could not hold air pressure (wanted fractions of inch water gauge) - went on for months - drove customer mad - had not realised average air duct leaks like a sieve - had to locate leaks & caulk/seal all joints & leaks. Finally system running & worked well. From this job, now produce seamless conduits, etc. & no problems since.	CSR - Pyrmont - Rum Storage / Distillery. Explosive atmosphere. High expansion foam. Highly flammable. Diesel driven fan. Seamless conduits.
352-402	**<u>2). Before coming to Sydney - small Carbon Dioxide job for 200watt broadcast transmitter in Warrnambool (3WL) in Melbourne.</u>** At time administered by PMG's Department. When was a young man - for the system Wormald used a detector which comprised a small air filled reservoir - when temperature rose, air expanded & operated diaphragm tripping mechanism. On day to be commissioned - man from PMG's Dept arrived - hat, pipe,etc... & said "Son, I don't think that's going to be much good, how are you going to test the detector ?" Answer - "We usually do with hot water". Reply - "Do that" - so I did - then he said "Very good, well done - but where am I going to get hot water when I burn out a little resistor here?" Huge embarrassment - Wormald should have recognised. Result - not long after - went to Switzerland & spoke to man who invented ionization chamber detector - revolutionised the technology all over the world. Was ideal for application & PMG were delighted - protected repeater stations all over Australia.	Carbon Dioxide system. Broadcast transmitter in Warrnambool, Melbourne. 3WL. PMG (Post Master -General's Department). Wormald. Switzerland Ionization chamber detector. Repeater stations.
402	**End of Tape IEA SYD : DWB 6, Side B**	

Tape Log

Tape: IEA SYD: DWB 7, Side A		
COUNT	**SUBJECT**	**NAMES & KEYWORDS**
000-004	Tape Identification.	
004-044	**3). Carbon Dioxide system for the then Standard Motor Company in Port Melbourne** - produced Vanguard & other motor vehicles. Had ***huge paint spray booths*** which they wanted protect with Carbon Dioxide. At the time, company had old carbon dioxide system which used cable release mechanisms, fusible links, pulleys & weights, etc.. - pretty "Heath Robinson". Wormald asked do re-vamp of whole system - Client's Chief Engineer - Bob Tewkesbury - gave job briefing. Work to redesign/ re-vamp old system & bring to then present day standards started. Decided replace all cable release systems with thermostatically controlled ones. Wormald did not have proprietary thermostat so selected vendor - also developed alarm panel to give indication of location of offending zone in complex of spray booths & ducts. Was showpiece installation - full scale tested - performed well - all happy. Followed by endless rain which got down ducts & soon all thermostats shorted. Got over problem by learning how to encapsulate all properly - a lot of work. Learnt valuable lesson when change from linkage operated systems to electric ones.	Carbon Dioxide system. Standard Motor Company. Vanguard. Paint spray booths. Cable release mechanisms. Fusible links. Pulleys & weights. Bob Tewkesbury (Chief Engineer) Thermostatically controlled. Wormald. Thermostats.
044-089	**Changes in fire protection & management technologies over the past 45 years.** **1). One national standard for buildings - "Building Code of Australia"** - covers all facets, including Fire Protection. A sophisticated document run by full time directorate with good expert input which includes fire engineering side of business. This followed abortive attempts to get 'Australian Model Uniform Building Code' (AMUBC) up & running - was never successful. **2). Fire modelling** - considerable improvement by use of computer modelling & CAD techniques, also fast response sprinklers & being able to assess their time constants. Much more fire "engineering" (calculation & modelling) being applied to contemporary problems. Enables look at specific fire risk situations : • Fire load density. • Rate of fire development. • Temperatures achieved. • Time for sprinkler operation. • Model evacuation times. • Extent & type of fire protection required. All this is far jump from old prescriptive approach of picking up rule book & saying will have 3 of these, etc... More work still to be done for validation of some models - but when that done, maybe another half decade, will get greater confidence in modelling all sorts of fire scenarios. **3). Performance based approach to fire protection** **These three have made a profound difference to way business is done & to the standard of fire protection achieved.**	Building Code of Australia - one national standard for buildings. Australian Model Uniform Building Code, AMUBC. Fire modelling. Computer modelling. CAD Fire risk. Fire load density. Rate of fire development.

089-133	**<u>High Rise Buildings - special philosophies & technical approaches to fire protection & fighting fires in high rise buildings.</u>** 1961 - when left Melbourne, was not one high rise structure in that city & only one in Sydney - AMP building at Sydney Cove. Trend now to ever taller buildings. With fire brigade turntable ladders, impossible reach over about 7 storeys. Once go above 5 - 7 storeys, different philosophy about fire protection because have to fight fire from within. In Australia, every building over 25metres height has to be fully sprinkler protected throughout & have own in-built protection, own adequate water supplies, early warning system, direct connection to fire brigade - ie. almost be self sufficient in terms of fire protection. Must decide how best to accommodate the fire brigade when they arrive. Even though building has in-built water supplies, fire brigade like to be able to boost water supplies as they deem appropriate. In Victoria, this done from ground level - in NSW. idea is to take a portable pumping set to appropriate point & hook into main fire riser - this more cumbersome approach due need to lug all gear up & fit up properly - hence must make sure space always reserved for gear, etc. Tall buildings - main problem is getting people out or finding safe refuge for them in building & not being dependent on fire brigade doing total job. In Australia, there is very high standard of fire protection in tall buildings.	High rise buildings. Melbourne Sydney AMP building, Farm Cove. Fire brigade turntable ladders. Sprinkler protected. In-built protection. Water supply. Early warning system. Fire Brigade. Boost water. Victoria N.S.W. Portable pumping set. Safe refuge.
133-164	**<u>Some of worst kinds of fire disasters in the past & how protection of such installations would be approached today.</u>** **<u>1). 1952 - General Motors in Michigan (USA).</u>** Totally destroyed hydromatic transmission plant. Two factors involved : • some sprinkler protection was provided - but only partial protection -"refined form of Russian roulette". Fire broke out in parts dipping operation (from which sprinklers had been excluded) - fire was able gain significant foothold before encountered a protected zone which was subsequently overwhelmed because opened more sprinklers than was designed to open. • fire able to leap frog along under roof because was built up roof - was typical in US with flammable mastic compounds between layers of felt & material liquefied & dripped ahead of the fire & extended the fire at a frightening rate. Firstly, underlined utter fallacy of partial protection as opposed to total protection - a gamble which invariably fails to pay off. Secondly - some very significant changes, from underwriting standpoint, in treatment of roof construction in United States from that point on.	Fire disasters. General Motors, Michigan (USA) Sprinkler protection. "Russian Roulette" Parts dipping operation.. Roof construction. Flammable mastic compounds.
164-178	**<u>2). 1959 - great Pentagon fire (USA)</u>** - in which lost very important (from defence standpoint) battery of computers This fire really began whole movement to fire protection of electronic data facilities around world - prior to this, computer had been considered a non burnable entity.	Pentagon, USA. Computers Electronic data facilities.

178-208	**3). 1963 - Bulk Sugar Terminals at Townsville.** Burnt for 3½days - prior, best opinions had considered as minimal hazard that sugar is likely to burn. Fire Chief flew up from Brisbane on second day - only to find none of equipment he was about to ship up would connect with that in Townsville - fire hose couplings & fittings of different diameter & thread form. ***Fittings standardisation further discussed on this side of this tape at counter nos. 243-268.*** Fire affected Queensland economy & had very big impact on standardisation of couplings, etc all over Australia.	Bulk Sugar Terminals, Townsville. Brisbane Fire hose couplings & fittings.
195-208	**4). 1974 - Flixborough, (Nypro Chemicals) in UK** - all to do with a flexible connector between two pieces of process plant & plant on either side had no exposure protection of any kind - was huge explosion & fire. Profound impact because in Australia & USA, more process plant then covered by water spray exposure protection - could have made difference at Flixborough. This was a landmark fire.	Flixborough, (Nypro Chemicals), UK. Flexible connector Exposure protection. Australia, USA.
208-243	**5). 1988 - Piper Alpha, offshore in North Sea.** Perhaps greatest single loss in history - lessons came out in maintenance procedures, tag out procedures & so on & misunderstanding which led to the problem. Wormald UK had protected some 80% of installations in the North Sea with very extensive protection - only did small part of Piper Alpha. Cannot build one today without most extensive & formalised risk assessment study - submitted to authorities before commence. Risk Analysis has been retrospectively applied to upgrading works.	Piper Alpha, North Sea. Offshore installation. Maintenance procedures. Tag out procedures Wormald Risk assessment study
243-268	***3). Townsville 1963 fire - re fittings standardisation*** : Fittings standardisation still not resolved today. Queensland has made meaningful attempt to have state wide standards - but several states not the same as other states. Lot of effort in Standards Australia - but still do not have a national standard for fire hose couplings - huge expense involved in retrofitting..	Fittings standardisation. Queensland Standards Australia. Fire hose couplings.
271-285	**6). High rise buildings.** **6.1). 1973 - Sao Paulo in Brazil -** big fire in tall building - was absolutely engulfed - typical towering inferno. **6.2). 1971 - Tae Yon Kak Hotel in Seoul, South Korea** - in which some 130 people died - thinks may have been more (unregistered guests). These are just two of a dozen or more high rise fires recalled. Highlight - unless intelligent approach right at beginning with high rise as done in Australia, brigade is powerless - helicopters - look good in movies - but very difficult to utilise in practice.	High rise buildings. Sao Paulo, Brazil Towering inferno. Tae Yon Kak Hotel, Seoul, South Korea. Helicopters.
285-290	**7). 1998 - Esso's natural gas processing plant at Longford in Victoria** - fire followed an explosion on 25 September 1998. Would be most serious outbreak in our history to date when looking at downstream effects - shut off Victoria's gas supply for nearly a fortnight. Have not had a larger loss in total from the cumulative effects.	Esso natural gas processing plant, Longford, Victoria.

290-300	**8). 24 March 1999 - Mont Blanc tunnel - 11½ km long in Europe** - this fire very important because currently in Australia - virtually every city - tunnels being built. In Australia, are fully protecting with water sprays & advanced detection systems & hydrant systems, reversible air handling systems & so on - which did not exist at Mont blanc - certainly water sprays did not.	Mont Blanc tunnel in Europe. Water sprays, advanced detection systems, hydrant systems
300-325	**Role of governments in fire protection & management & current approach - effective?** Thinks current approach on part of government in terms of 'Building Code of Australia' is quantum leap from 40 years ago - always had set of regulations but were highly prescriptive, unyielding when finding preferred solutions. Most exciting about present situation is - very close to having an agreed national approach. When 'Building Code of Australia' first introduced - although purported to be national code - there was another book of State variations, almost as thick - were huge variations from State to State. In last couple of years, States have now reduced to only slim volume of exceptions - now very close to having an agreed national approach. Feels current approach from government is excellent - furthermore they increasingly permitting 'engineered ' solution approach, i.e. the alternative approach, so can put imaginative thinking into it. This great benefit - can build huge structures, eg .vast shopping malls & huge atrium type enclosures that building codes could never have covered - can do with some degree of confidence.	Role of governments Building Code of Australia. Regulations. National code. States. 'Engineered' approach. Shopping malls. Atrium type enclosures.
325-361	**Awards :** **1). Fellow - Society of Fire Protection Engineers, USA.** - made "in recognition of significant accomplishment & stature in engineering". Society is regarded as pre eminent society for fire protection people - happens to be of American origin - but is spread throughout the world. Was first Fellow in Australia - awarded 1982 - & first outside USA. Awarded on basis - at that time & at that age, was thought to have accomplished fairly catholic education in fire protection & made some reasonable contributions, for example, helped in drafting of examinations for admission to the Society in USA, served a stint on Board of Directors, was acknowledged that he important link in fire protection industry in Australia & couple of peers had been here & looked at number of major installations which he had overseen.	Fellow, Society of Fire Protection Engineers, USA. American origin. Australia
361-412	**2). Medal of Order of Australia in the General Division** - made "for services to industry, particularly in the area of fire protection" - made 1990 - very honoured, on day invested was only one from industry. Largely question of nomination by one's peers - but in this case, Wormald Chairman in 1980's appointed to a government study group to look at preparedness of Australian industry in event of contingent circumstances - way of saying - in event of war, was industry in a position to support - he had two sectors to look after - ship building & general engineering. Ship building was about "dead in the water" as not building big ships at time. General engineering - covered a vast scope of	Medal of Order of Australia in the General Division. Fire protection. Wormald War, industry. Ship building, general engineering.

	manufacturing , as distinct from civil work - spent 6 months seconded to Dept. of Defence on Chairman's behalf examining various industries all Australia - their general resources, what might happen if there were a war, could they step up production & so on -culminated in a very significant report which Chairman presented. Because of this involvement - considered a reasonable service to industry - very extensive cataloguing of all sorts of industries from propeller makers to plastics moulders, foundry capability, ship lifting capability - so think this probably how came about. In addition had spent life time in fire protection industry. Think this is how citation developed.	Dept, of Defence. Propeller makers, plastics moulders, foundry capability, ship lifting capability.
412	**End of Tape IEA SYD ; DWB 7, Side A**	

Tape Log

Tape: IEA SYD: DWB 7, Side B		
COUNT	**SUBJECT**	**NAMES & KEYWORDS**
000-003	Tape Identification.	
003-027	**3). United Nations Environment Program - Citation of Excellence 1989** - made "in recognition of outstanding contribution to protection of the Earth's Ozone Layer". When ozone depletion problem arose - particularly with halons. As result of Montreal Protocol - which Australia signed - we obliged to severely cut back use of CFC's & halons - affected refrigeration, foam blowing & fire protection industry - needed to take decisive action. Series of seminars around Australia - arranged by environmental authorities - became involved & made presentations about available alternatives & fact we could survive without halon. Looked at directions we might head in order to research the alternatives. Victoria & NSW were first states who wanted enabling legislation for this to occur to phase out halons -needed to draft regulations & was asked to head small multi-disciplinary group - fire protection, manufacturing, trade unions, etc.. - drew up guidelines - parliamentary draftsmen put in appropriate language - subsequently became legislation. All of this activity caused UN award to occur to Barry Lee & several others.	United Nations Environment Program - Citation of Excellence 1989. Earth's Ozone Layer. Halons. Montreal Protocol. CFC's Refrigeration, Foam Blowing, Fire Protection. Environmental authorities. Victoria, NSW Enabling legislation Regulations manufacturing trade unions parliamentary draftsmen Legislation
027-043	**4). Inaugural Standards Award (1993) - Standards Association of Australia** - made "for meritorious commitment to the work of Standards Australia and the cause of standardisation". Proud of this - been involved with Standards work almost all of working life as a working member on several committees, several of which chaired - still does. When time came that SAA decided issue these every year or other year to one or two people for long service to standards, happened to be in first crop of recipients.	Standards Award. Standards Association of Australia. SAA
043-090	**Memberships:** **1). Australian Fire Protection Association (AFPA)** - concerned mostly with education & technical aspects. Past President - two occasions 1992-93 & 95. Represented AFPA in 1969 at third conference of Confederation of Fire Protection Association (CFPA) in Stockholm & in 1993 at CFPA meeting in Paris. Was last President of AFPA - because it merged with another group - Fire Protection Industry Association (a trade association with heavy bias in shadow committees in standards work - took off this technical part to merge with AFPA) to become a new group - "Fire Protection Association Australia" (FPAA). Was 'Charter President' of new group - FPAA. FPAA essentially a technical & educational organisation designed to promote better fire protection & fire safety in Australia - eg. Bushfire preparedness & standards, hints to householders about better fire protection practices, technical support to SAA (has shadow committees). Is a non profit organisation. Information is disseminated by internet, journal, periodicals, radio spots, in schools, etc.....	Australian Fire Protection Association (AFPA). Confederation of Fire Protection Association (CFPA). Stockholm, Paris. Fire Protection Industry Association. Fire Protection Association Australia (FPAA). Fire protection. Fire safety. Bushfire standards. Hints to householders. SAA. Internet

090-107	**2). Fire Protection Industry Association of Australia.** - trade organisation - mentioned in 1). above. Was President in 1994. Intended to promote betterment of fire protection industry & all who play a part in it - involves testing agencies, professional fire service, fire equipment manufacturers, fire service engineers, consultants, etc… Attempted achieve this by inputting into Australian standards (set up shadow committees to SAA's committees) - refer 1) above - this imported to FPAA so work continues.	Fire Protection Industry Association of Australia. Trade organisation. Testing agencies, professional fire service, fire equipment manufacturers, fire service engineers, consultants. SAA committees.
	3). Standards Australia - Chairman of : • **SAA & SANZ Fire Protection Standards Co-ordinating Group.** • **Technical Committee on Automatic Sprinklers.** • **Technical Committee on Fire Service Pumps.** Still holds these positions.	Standards Australia SAA, SANZ Fire Protection Standards Co-ordinating Group. Technical Committees on - Automatic Sprinklers - Fire Service Pumps.
107-140	***Role of Standards committees & the standards they produce on development of fire protection technologies in Australia :*** There are several hundred standards which relate to fire protection - more important of those concern standardised fire testing methodology - for assessing things such as fire doors, elements of construction, columns, beams, etc… Also expansive standards for special hazards - two being for automatic sprinkler practice & fire service pumps (key to many fire protection installations) - criteria for pump selection, way pumps should be assembled, auxiliary equipment, method of test - all laid down in standard. Very important to have ordered & consistent approach to fire protection standards as more & more standards are involved in 'Building Code of Australia' - so have to be very careful how they are structured because become law once accepted into that code. Must not have conflict between standards - must be complementary to one another. Between Australia & New Zealand where there is lot of joint standards activity set up - **Fire Protection Standards Co-ordinating Group** oversees the process, prioritising, general technical content for both sides of the Tasman - currently chairs this group..	Standards Fire protection Fire doors. Automatic sprinkler practice. Fire service pumps. Building Code of Australia. Australia New Zealand Fire Protection Standards Co-ordinating group.
140-157	**How Standards respond to change in technology** Done in various ways : a). Having active committee structure with participants who are deeply involved in technologies concerned & can bring to the table new developments as & when they occur. b). Approach should be that no standard should have life in excess of , say, 5 to 7 years - if been existing this long & not been heavily revised - should go back into public arena - with objective of picking up current technology. c). Outreach to International Organisation for Standardisation helps considerably - is extension of local works. Overall, Standards Australia make quite a creditable effort to keep abreast of current technology.	Standards - changes in technology. Standards committee. International Organisation for Standardisation (ISO). Standards Australia.

157-193	**Member of** **1). Standards Australia Council.** **2). International Standards Policy Board.** **3). SAA / SANZ Building Standards Policy Board.** **4). SAA Technical Committees on** • **Fire Extinguishers.** • **Fire Hose Reels.** • **Gaseous Fire Extinguishing Systems.** • **Fire Hydrants.**	Standards Australia Council. International Standards Policy board. SAA/SANZ Building Standards Policy Board. SAA Technical Committees.
157-193	**1). Standards Australia Council.** **Council** - quite big body with representatives from all groups which subscribe to or input to standards - includes representatives from State & Commonwealth Governments, major utilities, major trade associations, groups such as Housing Industry Association of Australia & Fire Protection Association. Council is governing body which sets & endorses all policy Standards management wants to pursue - has wide cross section of interest. From it's numbers is drawn a small group to make up **Executive Board** which functions as any other board. Beneath **Executive Board** - in order to administer the vast range of standards that Standards Australia deals with - are **Sector Boards**. One of interest is **Building Standards Policy Board** on which Barry Lee represents fire protection interests - others represented are housing people, structural group, timber framing group, limit state design for steel, Cement & Concrete Association, architects, engineers & so on. Between the **Standards Policy Boards** & the "coal face" - i.e. committees actually drafting standards- are **Co-ordinating Boards**.	Standards Australia Council. State & Commonwealth governments. Housing Industry Association of Australia. Fire Protection Association. Executive Board. Sector Boards. Building Standards Policy Board. Cement & Concrete Association Co-ordinating Boards.
193-241	**2). International Standards Policy Board.** Has become increasingly important that Australia cannot operate in isolation. Big efforts now internationally to globalise standards - one of prime players is International Organisation for Standardisation (ISO) & International Electro Technical Commission (IEC). ISO looks after all mechanical standards. IEC looks after electro technical matters. They produce the ISO standards. They are generally regarded as the prime international standards organisations - have in their membership the national standard setting authorities of most of the countries around world. Each country which has participating status has an obligation by virtue of membership to adopt that standard in it's own nation to the extent possible. It also has a vote in the setting of the standard & when standard is drawn up & finally published as an ISO standard, is supposed to adopt that standard or have very good reasons why it does not - invariably it does. If country has additional requirements that it must have because of government inputs or something - they are provided as an addendum. Work of international standards is extremely important - following example affected Wormald - Wormald had been producing malleable iron pipe fittings in United States - but not paid much attention to work going on in an ISO committee in Europe but which did	International Standards Policy Board. Globalise standards. International Organisation for Standardisation (ISO), headquartered in Geneva. International Electrotechnical Commission (IEC). Government. Wormald. Malleable pipe fittings. Europe.

	impact on the work considerably. A standard had been adopted that said we will "bead" some fittings & "band" others - this will denote whether they will have parallel (band) or tapered (bead) thread. Got under the guard of the company which operates six foundries in US - suddenly found it was producing something that would no longer be acceptable in Europe. So participation in International standards is vitally important. **International Standards Policy Board** meets in Australia - is a board specially set up within Standards Australia to specifically concentrate on it's relationship with ISO & IEC to make sure - a). we get the right delegates to those meetings & fund them to the extent necessary (often essential for people retired or part retired who have funding difficulties). b). to make sure we have a national viewpoint - properly put together here & presented. c). to generally look after all aspects of the international adoption of our own documents.	US International Standards Policy Board. ISO, IEC.
241-247	**3). SAA / SANZ Building Standards Policy Board.** Very similar in character to the International but solely concerned with building standards in Australia & New Zealand - meets alternatively in Australia & New Zealand.	SAA/SANZ Building Standards Policy Board. Australia, New Zealand
247-282	**Represented Australia on :** • **Technical Committee 21 of ISO.** • **Chairs ISO / Technical Committee 21 / Sub Committee 8.** ***Technical Committee 21 - concerned with fire protection & fire fighting equipment.*** ***Sub Committee 8 - concerned with gaseous fire extinguishing systems.*** Sub Committee 8 meets about every 9 months - due to meet in Moscow shortly - will be it's 9th meeting. Sub Committee 8 responsible for development of international standards relating to the application of gas type fire extinguishing systems - is very important because at moment in Germany, in UK, in Australia, in USA & several other countries -already there are already existing national standards for gas systems. There are some varying approaches both technically & in philosophy - so getting that group to agree on an international standard is not an easy matter - particularly when they are committed to adopting it at the end of the day. But making good progress - everyone wants a standard that can be applied equally - we in Australia regard it as important because if we want to do work in Vietnam, Korea or elsewhere with our near neighbours, we have to have something which purports to be international in character, not just a domestic Australian standard.	Technical Committee 21 of ISO. Sub Committee 8 of ISO. Fire protection & fire fighting equipment. Gaseous fire extinguishing systems. Moscow. Germany, UK, Australia, USA. Vietnam, Korea.
282-311	**National Fire Protection Association (NFPA) - USA.** Member of NFPA. Member of committees on sprinkler systems : • Discharge criteria. • Installation Criteria.	National Fire Protection Association (NFPA) - USA Sprinkler systems. Discharge criteria.

	NFPA is big organisation - aim is to provide better fire protection for American community - global aspirations. NFPA is major standards maker in own right - has huge suite of standards well known all over world. Could well represent as international standards. Pays huge attention to dwelling fires, fires in industry, best means of fire prevention / fostering best standards in fire departments. Considered role model in fire protection associations. Helped to form **Australian Fire Protection Association** in 1960 - although we totally independent from it - we are modelled on it.	Installation criteria. Dwelling fires, fires in industry, fire prevention. Australian Fire Protection Association.
311-328	**<u>Fire Protection Association - UK.</u>** Member of this association, Set up in Britain - originally by insurers - now virtually run by public to promote better fire protection in Britain. Reasons for belonging to these associations - • whatever we are doing, they doing in a bigger way because of their 'critical mass'. • very free with interchange of information. • great support to us in getting our own Fire Protection Association on a sound footing. • they have a very prominent role in standards setting,	Fire Protection Association - UK. Britain
328-387	**<u>The Institution of Fire Engineers in UK.</u>** Fellow of this Institution. Past President New South Wales Branch in 1978-80. Been active on executive committee for many years - really since admission in 1958. Also, Patron of the Institution in Australia. Had it's origins in UK about 75 years ago - originally started as means of putting more technology, or engineering discipline, into fire brigades who were increasingly faced with complex apparatus, had all sorts of maintenance problems that had hither to not experienced.. Also, fire brigades have to maintain major monitoring facilities for street & telephone fire alarm systems - became an increasing technical business. So, some 75 years ago- agreed needed a technical body. Not necessary to join, but by examination many chief fire officers & so on , could join. Not long after inception, realised needed, • a more advanced curriculum. • a much wide scope than just fire service people. Began to admit members, by examination, from all sorts of areas, eg. architects, mechanical & civil engineers, research people - in a way it competes with the **Society of Fire Protection Engineers in USA.** Has constantly increased technical standards to point where now is possible with highest level of examination in Institution, to get Chartered Engineer status in the UK. ***<u>In summary</u>*** - originated as sort of professional arm of fire service & gradually became catch all for fire protection practitioners in the field, particularly in Europe. Started in UK - but is active in lot of countries, eg. Germany, Scandinavia & now in the USA.	The Institution of Fire Engineers in UK. New South Wales. UK Fire brigades. Monitoring facilities. Street & telephone alarm systems. Chief fire officers. Architects, mechanical & civil engineers. Society of Fire Protection Engineers, USA. Chartered Engineer. Europe Germany, Scandinavia, USA
387	**End of Tape IEA DWB 7, Side B**	

Tape Log

Tape: IEA SYD: DWB 8, Side A		
COUNT	**SUBJECT**	**NAMES & KEYWORDS**
000-004	Tape Identification	
004-030	**The Society of Fire Protection Engineers - USA.** Past member of Board of Directors in USA - served for 2 terms (1981 through 1987). Past President of Australian Chapter (1969 through 1971). Missed very few Board meetings as with Wormald travelled to USA fairly frequently with business commitments & interests. The Institution of Engineers, Australia has in one College - a Society of Fire Safety Engineers which is quite active in Australia. Recently, this Australian Society, the Society of Fire Protection Engineers in USA & a UK group (could not recall name) agreed to combine their operations & to co-work. This is something Barry Lee has sought from early 1960's - a stronger association between Society of Fire Protection Engineers in USA & The Institution of Engineers, Australia - so it is coming to pass anyway - even though it is taking a long time.	The Society of Fire Protection Engineers - USA Wormald Institution of Engineers, Australia - one College. Society of Fire Safety Engineers. Society of Fire Protection Engineers, USA.
030-050	**Development of training in Fire Engineering.** When began career (early 1950's), fire protection engineers were drawn from any discipline - i.e. aeronautical, mechanical, civil, marine, & so on - just simply learnt the profession by practice. There were no formal university courses available at under graduate level - could Masters at Edinburgh University & a couple of others - but already had to be well advanced in your profession.. Since then, many universities in USA - 6 or 7 major ones - offer at least BSc or BE program in fire protection engineering - so can start from day one to have electives in fire protection, particularly in field of hydraulics. University of Technology in Victoria, University of Technology in Sydney, University of Western Sydney - today all offer at least undergraduate programs in Fire Engineering - so things have changed very much.	Training in Fire Engineering Fire protection engineers. Aeronautical, mechanical, civil, marine. Edinburgh University. USA BSc. BE University Of Technology (Victoria). University of Technology (Sydney). University of Western Sydney.
050-055	Close of Interview, thanks, etc.	
055	**End of Tape IEA SYD : DWB 8, Side A**	

NOTE : Tape IEA SYD : DWB 8, Side B was not used.